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Data for the Screening Assessment
Volume I: Text
Columbia River Comprehensive Impact Assessment

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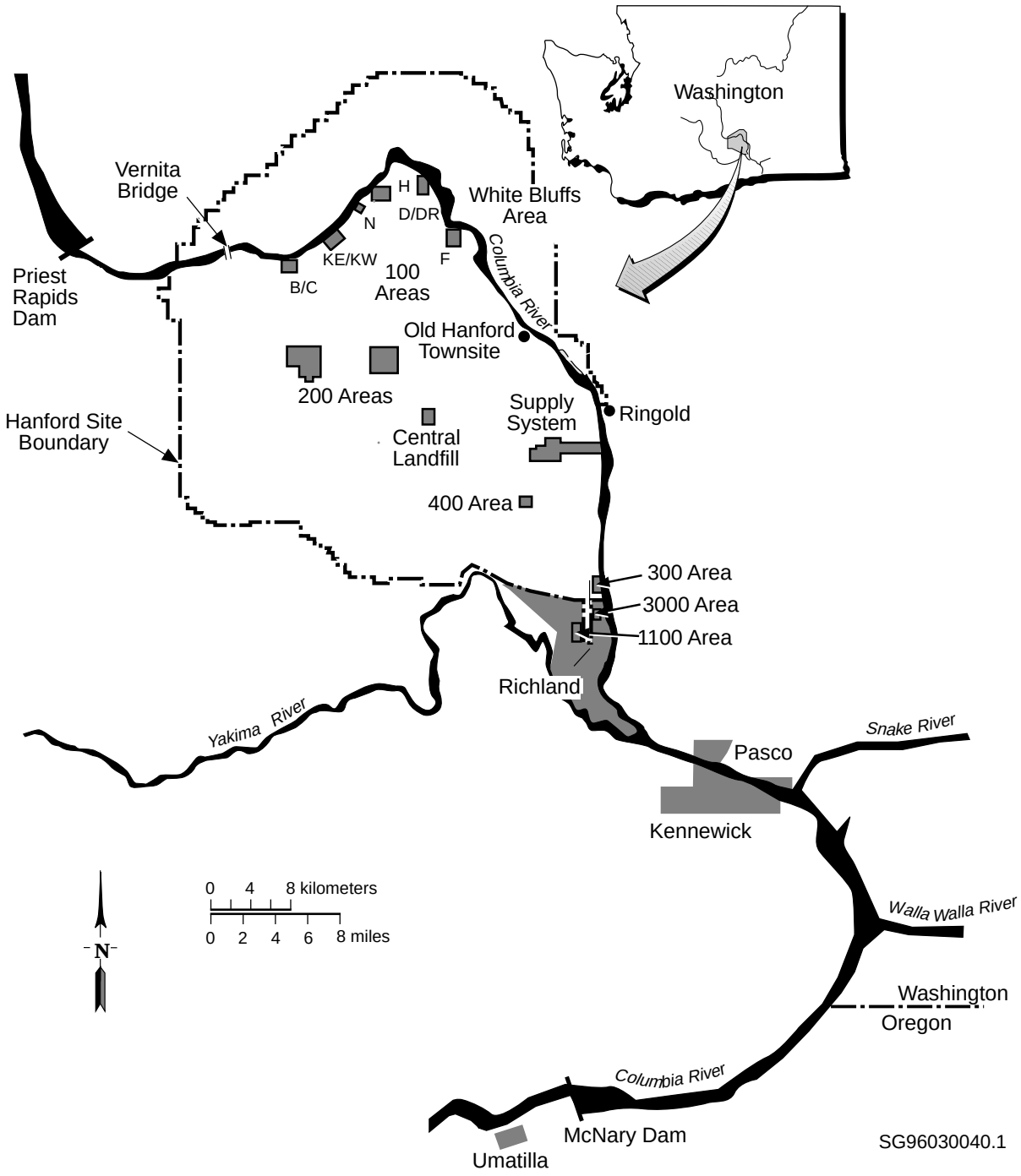
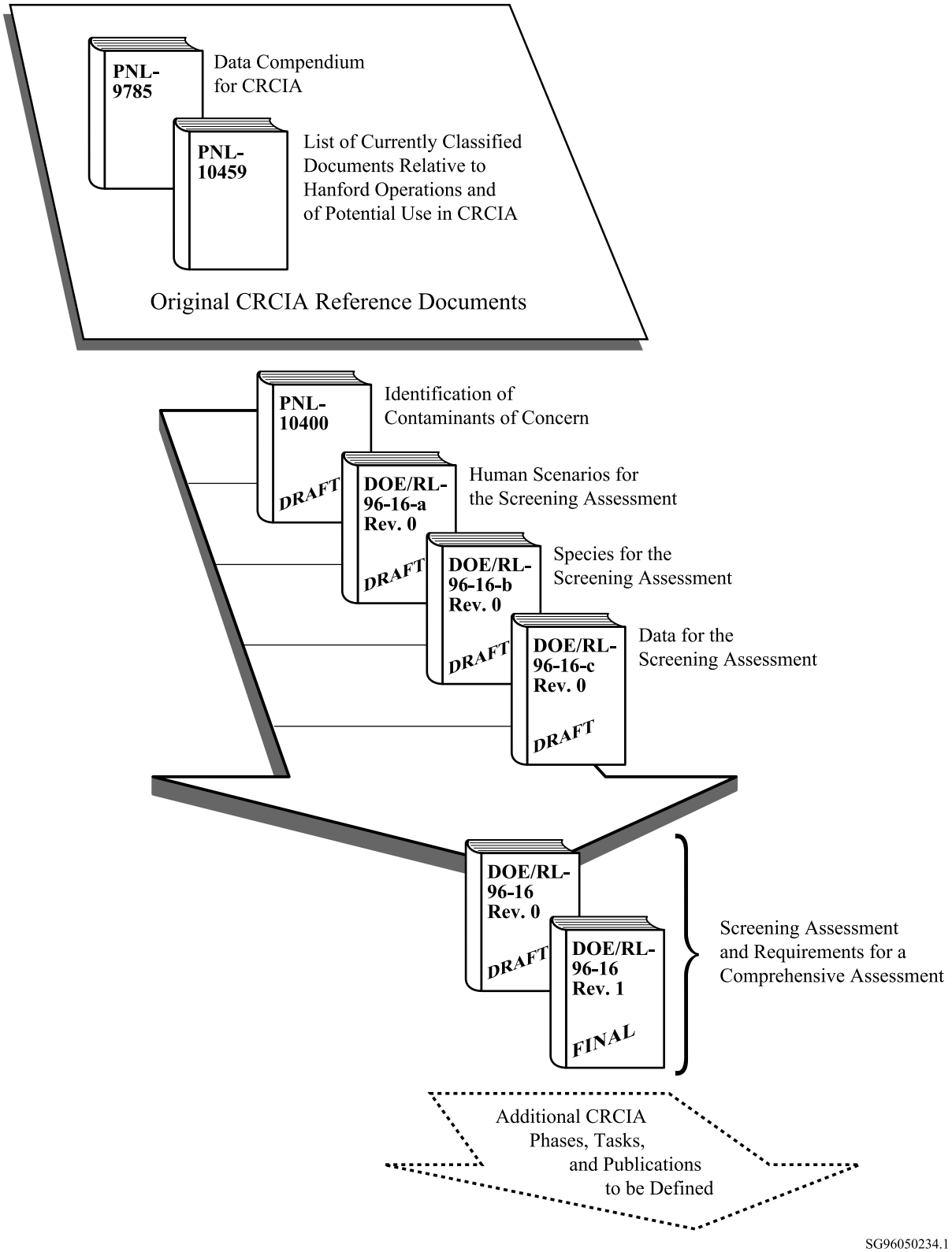


Figure P.1. Map of Screening Assessment Study Area: Vicinity of Priest Rapids Dam - McNary Dam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FINAL
Screening Assessment
and Requirements for a
Comprehensive Assessment
Additional CRCIA
Phases, Tasks,
and Publications
to be Defined
SG96050234.1

Figure P.2. Publications in the Initial Phase of the Columbia River Comprehensive Impact Assessment

Preface

The Columbia River is a critical resource for residents of the Pacific Northwest. It provides for basic needs and is interrelated with the life style and quality of life for Columbia Basin's many human and non-human residents. This resource drew the Manhattan Project's planners to the site now called Hanford to produce nuclear weapon materials. Production of those materials has left behind a legacy of chemical and radioactive contamination and materials that have, are, and will continue to pose a threat to the Columbia River for the foreseeable future.

To evaluate the impact to the river from this Hanford-derived contamination, the U.S. Department of Energy, U.S. Environmental Protection Agency, and State of Washington Department of Ecology (the Tri-Party agencies) initiated a study referred to as the Columbia River Comprehensive Impact Assessment (CRCIA). To address concerns about the scope and direction of CRCIA as well as enhance regulator, stakeholder, tribal, and public involvement, the CRCIA Management Team was formed in August 1995. The CRCIA Team meets to share information and provide input to decisions made by the Tri-Party agencies concerning CRCIA. Representatives from the Confederated Tribes of the Umatilla Indian Reservation, Hanford Advisory Board, Nez Perce Tribe, Oregon State Department of Energy, Yakama Indian Nation, Tri-Party agencies, and contractors are active participants on the team.

A major CRCIA Team decision was to organize CRCIA into phases, with additional phases to be identified as warranted after completion of the initial phase. The initial phase is comprised of two parts: 1) a screening assessment to evaluate the current impact to the river resulting from Hanford-derived contamination (see Figure P.1 for map of screening assessment area) and 2) identification of requirements considered necessary by the CRCIA Management Team for a comprehensive assessment of impact to the river.

This *Data for the Screening Assessment* report is the fourth in a series of reports which have been issued as part of the initial phase. Figure P.2 depicts the documents which have been and will be issued in the initial phase. After the data report and three previously published reports have been revised, they will be incorporated into a two-part report which will document the results of the two parts of the initial phase of CRCIA: the screening assessment results and the requirements for a comprehensive assessment.

Background

The Hanford Site occupies 1456 square kilometers (560 square miles) in the south central portion of the State of Washington. It is located northeast of the Tri-Cities of Richland, Kennewick, and Pasco. The site is partially bordered on the north and east by the Columbia River and includes a relatively narrow buffer zone north of the river referred to as the Wahluke or North Slope. The Hanford Site is located on land ceded in 1855 by treaties with the Confederated Tribes of the Umatilla Indian Reservation and the Yakama Indian Nation. The Nez Perce Tribe has treaty rights on the Columbia River. The tribes were guaranteed the right to fish at all usual and accustomed places and the privilege to hunt, gather roots and berries, and pasture horses and cattle on open and unclaimed land.

From 1944-1987, the U.S. Department of Energy (DOE) conducted nuclear production operations at the Hanford Site along the Hanford Reach of the Columbia River. The Hanford Reach extends 85 kilometers (51 miles) downstream from Priest Rapids Dam to the head of the McNary Pool near the city of Richland, Washington. These past nuclear operations resulted in the release of hazardous chemicals and radionuclides to the Columbia River and into the soil. These operations also resulted in the storage of wastes and nuclear materials, some of which have escaped containment or have the potential for doing so. Current conditions of the Columbia River reflect that contamination is reaching the river primarily via the groundwater pathway.

In addition to contamination resulting from past and present Hanford operations, there is the potential for more contamination because the Hanford Site is being used for storage and disposal of nuclear materials, radioactive waste, chemically hazardous waste, and mixed waste (nuclear materials mixed with hazardous chemicals). For example, presently two-thirds of the nation's high-level defense nuclear waste is being stored at the Hanford Site with continuing shipments of nuclear waste being received (DOE 1992). Much of this nuclear waste may remain at the Hanford Site. The storage of these nuclear wastes could potentially contribute to the contamination of the Columbia River (depending on the performance of the chosen isolation solution) for thousands of years.

As a result of the known contamination, four areas of the Hanford Site (the 100, 200, 300, and 1100 Areas) have been placed by the U.S. Environmental Protection Agency (EPA) on the national priorities list for cleanup. The national priorities list is a component of the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) (42 USC 9601) enacted by the U.S. Congress.

To address the cleanup needs mandated by CERCLA and to address the requirements for handling currently stored/generated wastes as mandated by the Resources Conservation and Recovery Act (RCRA) (42 USC 6901), DOE entered into a *Federal Facility Agreement and Compliance Order* (unofficially known as the Tri-Party Agreement) (Ecology et al. 1994) in 1989 with EPA and the State of Washington. Milestones have been adopted for the Tri-Party Agreement that identify actions needed to ensure acceptable progress toward Hanford Site compliance with CERCLA, RCRA, and the *Washington State Hazardous Waste Management Act* (RCW 1985).

During 1993, the Tri-Party agencies began work toward a comprehensive assessment of the impact of Hanford operations (past and present) on the current conditions of the Columbia River (DOE 1994). In January 1994, the Tri-Party Agreement was revised to reflect this project. This revision included a new Milestone, M-13-80B (later changed to M-15-80), that established CRCIA. In December 1995, the CRCIA milestone was revised, enhancing the review process and specifying target dates. In April 1996, another change to the Tri-Party Agreement provided additional time to perform the work in the initial phase.

Purpose and Scope of the Screening Assessment

The purpose of the screening assessment is to support cleanup decisions. The scope of the screening assessment is to evaluate the current risk to humans and the environment resulting from Hanford-derived contaminants. The screening assessment has the primary components of:

- identifying contaminants to be assessed
- identifying a variety of exposure scenarios to evaluate human contaminant exposure
- identifying a variety of other species to evaluate ecological contaminant exposure
- assessing risks posed by exposure of humans and other species to the contaminants

The study area for the screening assessment (see Figure P.1) was defined to extend from upstream of the Hanford Site in areas unaffected by Hanford Site operations down to McNary Dam, which is the first dam downstream of the Hanford Site. Historical data indicate that the concentrations of contaminants are as high or higher in this reach of the Columbia River than in areas downstream of McNary Dam. Other factors determining the study area include the availability of appropriate environmental data to conduct the screening assessment, the lack of such data downstream of McNary Dam, the known discharge of contaminants into the river (primarily via groundwater seepage) along the Hanford Site, and the resource constraints (time and dollars) originally imposed on the screening assessment. The parameters of the scope are:

Area:	Columbia River (vicinity of Priest Rapids Dam to McNary Dam), groundwater (up to 0.8 kilometer/0.5 mile in from the river), and adjacent riparian zone
Time:	January 1990 - present (date data were received for use in the screening assessment) with data gaps filled by earlier data where available
Contaminants:	Published in Napier et al. (1995) (to be modified in screening assessment report)
Scenarios:	Published in Napier et al. (1996) (to be modified in screening assessment report)
Receptor Species:	Published in Becker et al. (1996) (to be modified in screening assessment report)
Measured Media:	Groundwater, sediment, seeps, surface water, external radiation, biota, cobalt-60 particles, drive point groundwater, N Springs punch point water, and pore water

The primary contractor conducting the screening assessment is the Pacific Northwest National Laboratory. Bechtel Hanford, Inc. provides technical and public involvement coordination with environmental restoration activities. Technical peer reviewers are evaluating the work under the guidance of the Directors of the Oregon Water Resources Research Institute and State of Washington Water Research Center.

Work Integration and Documentation

The results of the initial phase of CRCIA are reported in a series of reports (see Figure P.2 and Table P.1). These reports reflect the process involved in the screening assessment of current risk. The reports published first as drafts will be compiled into one document on the screening assessment and requirements for a comprehensive assessment.

The process involved in the screening assessment was to first identify the documents containing pertinent data. That information was published in two reports (Eslinger et al. 1994 and Miley and Huesties 1995), which were issued as final reports.

The data documents listed in Eslinger et al. (1994) and Miley and Huesties (1995) helped to identify the most significant Hanford Site contaminants that affect the Columbia River. The winnowing process used to determine which of those contaminants should be evaluated in the screening assessment of risk was published in Napier et al. (1995) as a draft. The comments on the draft are being incorporated, and the contaminants information will appear as a section in the draft of the report on the screening assessment and requirements for a comprehensive assessment.

Next, groups of people with potentially different exposures to the Columbia River were identified. With information from the Hanford Site Risk Assessment Methodology (DOE 1995) and with input from the CRCIA Team, scenarios were written defining the potential pathways and exposures for the various groups. Input from the scenarios will be used in the screening assessment of human risk. The scenarios are described in Napier et al. (1996), which was published as a draft. The comments on the draft are being incorporated, and the scenarios information will appear as a section in the draft of the report on the screening assessment and requirements for a comprehensive assessment.

Simultaneously, the most significant species were identified and those to be evaluated in the screening assessment of ecological risk were selected. The species to be used in the screening assessment and the process used to select them are described in Becker et al. (1996), which was published as a draft. The comments on the draft are being incorporated, and the species information will appear as a section in the draft of the report on the screening assessment and requirements for a comprehensive assessment.

The monitoring data available, the lists of contaminants and species to be evaluated, and the selection rules developed by the CRCIA Team determined which data were selected for use in the screening assessment of human and ecological risk. The data to be used in the screening assessment and the process used to select them are presented in this draft report. The comments on the draft will be incorporated, and the data information will appear as a section in the draft of the report on the screening assessment and requirements for a comprehensive assessment.

The draft report on the screening assessment and requirements for a comprehensive assessment will provide the results of the screening assessment and a definition of the essential work remaining to provide an acceptable comprehensive river impact assessment. The comments on the draft will be incorporated and the screening assessment and requirements for a comprehensive assessment will be published as a final report.

Table P.1. Documents in Initial Phase of Columbia River Comprehensive Impact Assessment

Title	Document No.	Publication Date	Status
Data Compendium for the Columbia River Comprehensive Impact Assessment (Eslinger et al. 1994)	PNL-9785	April 1994	Final publication
List of Currently Classified Documents Relative to Hanford Operations and of Potential Use in the Columbia River Comprehensive Impact Assessment January 1, 1973 - June 20, 1994 (Miley and Huesties 1995)	PNL-10459	February 1995	Final publication
Identification of Contaminants of Concern (Napier et al. 1995)	PNL-10400	January 1995	Published as a draft - Issued first in January 1995 for review, then again in January 1996; comments from both review periods will be addressed and report will be a section in the *Screening Assessment and Requirements for a Comprehensive Assessment* report
Human Scenarios for the Screening Assessment: Columbia River Comprehensive Impact Assessment (Napier et al. 1996)	DOE/RL-96-16-a Rev.0	March 1996	Published as a draft - Then comments will be addressed and report will be a section in the *Screening Assessment and Requirements for a Comprehensive Assessment* report
Species for the Screening Assessment: Columbia River Comprehensive Impact Assessment (Becker et al. 1996)	DOE/RL-96-16-b Rev. 0	March 1996	Published as a draft - Then comments will be addressed and report will be a section in the *Screening Assessment and Requirements for a Comprehensive Assessment* report
***Data for the Screening Assessment*: *Columbia River Comprehensive Impact Assessment* (Miley et al. 1996)**	**DOE/RL-96-16-c Rev.0**	**June 1996**	**Published as a draft - Then comments will be addressed and report will be a section in the *Screening Assessment and Requirements for a Comprehensive Assessment* report**
Screening Assessment and Requirements for a Comprehensive Assessment: Columbia River Comprehensive Impact Assessment	DOE/RL-96-16 Rev.0	December 1996	To be published as a draft - Will incorporate all previous draft publications (not those published as final) plus sections on site characterization, screening assessment of risk, and CRCIA Team statement of work to be done after the initial phase
Screening Assessment and Requirements for a Comprehensive Assessment: Columbia River Comprehensive Impact Assessment	DOE/RL-96-16 Rev.1	April 1997	To be published final - Will incorporate responses to comments and minority opinions should any comments not be reconciled

Summary

The initial phase of the Columbia River Comprehensive Impact Assessment (CRCIA) is a screening assessment of risk to humans and the environment. To assess risk, monitoring data of contaminant concentrations are needed. The data task provides measurements of contaminant concentrations in various media for use in the human health and ecological screening assessments. This report is divided into two volumes. *Volume I: Text* describes the data gathering and data selection processes. *Volume II: Appendices* presents the 1) final data sets (media files) to be used in the screening assessments, 2) the raw data from which the data sets were derived, and 3) the raw data values for media for which other calculation methods will be used. (For a copy of Volume II with 500 pages plus 9 diskettes, contact S. D. Cannon at 509-372-6210.) The data task for CRCIA is being conducted under the guidance of the CRCIA Management Team. All defining decisions for the task were made with CRCIA Team concurrence

The scope of the data task is to compile data collected since January 1990 by the various monitoring programs for the contaminants of interest. The contaminants of interest for the screening assessment were originally defined in Napier et al. (1995) and have been revised based on comments received on that draft document.

The media for which concentration data are needed for the human health and ecological screening assessment calculations are groundwater, sediment, seeps, surface water, and external radiation. These media files along with the original raw data files are presented in this report. In addition, contaminant concentrations in biota, cobalt-60 particles, drive point groundwater data for chromium, N Springs punch point water data, and pore water data for chromium will be evaluated in the screening assessment. These raw data values are also presented in this report. However, because the availability of data applicable to the screening assessment is limited, other calculation methods will be used in the screening assessment for biota, cobalt-60 particles, drive point groundwater, N Springs punch point water, and pore water. Therefore, no media files needed to be prepared for these data.

The first step in the data gathering process was to identify sources of environmental data. A data compendium (Eslinger et al. 1994) provided a collection of references. Other sources of environmental data were identified by the CRCIA Team. In addition, a meeting was called with data managers and environmental leads at the Hanford Site who are familiar with river sampling activities. The purpose of this meeting was to summarize the data that had been gathered and to identify additional sources of data. This meeting was also used to determine which programs' data were stored in the Hanford Environmental Information System (HEIS).

Data for all media were initially gathered from a corridor up to 0.8 kilometer (½ mile) on either side of the Columbia River. For sediment, seeps, surface water, and external radiation, all data within 0.8 kilometer of the river were used. For the groundwater data, it was necessary to use only the portion of these data that would be relevant to estimating the contaminant concentrations entering the Columbia River from the Hanford Site. This was done by assigning a groundwater corridor width to the Hanford side of each segment. The corridor width was based on having sufficient groundwater data to characterize the

contamination within a segment. These corridor width decisions were made by staff from Pacific Northwest National Laboratory, U.S. Environmental Protection Agency, Washington State Department of Ecology, with concurrence by the CRCIA Team.

Once the sources of environmental data were identified, data were collected for January 1990 to the date the data were received. The data were reviewed with the environmental leads for the respective data sources to categorize the data appropriate for the media of interest. The data were then cross referenced with the contaminants of interest. After the data of the independent programs had been selected as appropriate for use within the scope of the screening assessment, the various data sets within a medium were combined into a single database.

The human health and ecological screening assessments calculate risk based on contributions from multiple pathways affected by contaminant concentrations in multiple media. These contaminant concentrations were not usually measured in a fashion that would allow a complete assessment at every sampling site. To provide data for the assessments, it was necessary to aggregate data to represent concentrations in areas rather than at points. This was done through the technique of river segmentation, resulting in 27 segments being identified.

The purpose of the data analysis process was to obtain concentration inputs to the screening assessment models from the raw concentration data. This process was repeated for each segment and for each contaminant being evaluated. The process involved choosing a maximum representative value for the concentration of each contaminant for a deterministic run and calculating the parameters that define the concentration probability density function needed for the stochastic runs.

The final data sets (media files) will be used in the human health and ecological screening assessments of risk. The work of the data task did not include analyzing the quality of the data. Data quality objectives will be discussed in the report on the screening assessment and requirements for a comprehensive assessment. Once comments are received, this data report will be revised and published as a section in the screening assessment report.

Glossary

100 Areas	site of the Hanford production reactors, which include B, C, D, DR, F, H, KE, KW, and N Reactors; see Figure P.1
300 Area	site of the research, development and fuel-fabrication operations; see Figure P.1
biota	plants and animals
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as Amended* (42 USC 9601 et seq. as amended)
concentration	amount of substance in a given quantity of material (for example, micrograms of chromium per liter of groundwater)
CRCIA	Columbia River Comprehensive Impact Assessment
CRCIA Team	Columbia River Comprehensive Impact Assessment Management Team
deterministic analysis	single calculation performed with a single value selected for each parameter, such as the concentrations of contaminants entering the river; see stochastic analysis
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERC	Environmental Restoration Contractor (Bechtel Hanford, Inc.; CH2M Hill Hanford, Inc.; IT Hanford, Inc.; Thermo Hanford, Inc.)
Geographic Information System	computerized system designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information
geometric mean	see “mean” for definition.
geometric standard deviation	measure of dispersion (variability) for lognormally distributed data; one of the stochastic parameters calculated from the set of median

	(best-estimate) well values in each segment; see also “geometric mean” under “mean”.
GW	groundwater
Hanford Reach	segment of the Columbia River that extends 85 kilometers (51 miles) downstream from Priest Rapids Dam to the head of the McNary Pool near the city of Richland, Washington
HEIS	Hanford Environmental Information System; an electronic database that consolidates the data gathered during environmental monitoring and restoration of the Hanford Site
irradiation	exposure of an object to radiation
lognormal distribution	data distribution such that the logarithms of the data form a normal distribution
maximum representative value	highest concentration value that is considered representative of the sampling location
mean	average value of a set of numbers
geometric mean	central value of a set of lognormal data; one of the stochastic parameters calculated from the set of median (best-estimate) well values in each segment; see also “geometric standard deviation”
winsorized mean	way of approximating the average for a set of measurements when some are below the level of detection; evaluated by leaving out as many of the highest results as there are non-detectable results
median	middle value in a series of values arranged in order of size
model	representation of a process or entity; the representation may be graphical or a set of mathematical equations that simulate the process or entity being modeled
outlier	data value determined by a statistical test to be outside the range of possible values in the given distribution
pdf	probability density function; set of all possible values of a parameter and their associated likelihoods

plume	volume of air, water, or soil containing contaminants released from a contaminant source
PNNL	Pacific Northwest National Laboratory
production operations	activities connected with the production reactors in the 100 Areas (B, C, D, DR, F, H, KE, KW, or N reactors) in which uranium or other fuel was irradiated with neutrons to produce radioactive materials; used primarily at Hanford to produce plutonium for weapons; used also for research
radionuclide	radioactive isotope of an element
RCRA	*Resource Conservation and Recovery Act of 1976* (42 USC 6901 et seq. as amended)
risk assessment	estimation of the severity and likelihood of harm to human health or the environment occurring from exposure to a particular substance or activity
screening assessment of risk	risk assessment with limited scope; for example, the initial phase of CRCIA is a screening assessment of risk because it is restricted to 1) current conditions, 2) the area between Priest Rapids Dam and McNary Dam, 3) a limited number of contaminants, 4) a few selected receptor species, and 5) a limited amount of monitoring data; the objective of the screening assessment of risk is to identify areas where significant potential exists for adverse effects on humans or the environment
SD	sediment
seeps	locations where groundwater oozes to the surface
SESP	Surface Environmental Surveillance Project
SP	seeps
stochastic analysis	set of calculations performed over the range of some of the input parameters; see deterministic analysis
SW	surface water
TLD	thermoluminescent dosimeter; identified as “external radiation” in the

	text of this report
TPA	Tri-Party Agreement (officially, *Hanford Federal Facility Agreement and Consent Order*)
Tri-Party agencies	Three government agencies (U.S. Department of Energy, U.S. Environmental Protection Agency, and the Washington State Department of Ecology) responsible for the cleanup of the Hanford Site
USGS	United States Geological Survey
WHC	Westinghouse Hanford Company
WPPSS	Washington Public Power Supply System